

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): An MIMO communication system comprising:

a transmitter with N (N is an integer equal to or greater than 2) antennas; and

a receiver with L (L is an integer equal to or greater than 2) antennas,

said transmitter comprising:

a transmission signal generator for generating a transmission signal;

a signal dividing unit for dividing the transmission signal into K (K is an integer equal to or less than smaller one of N or L) signal streams according to transmission weights derived from feedback information informed from the receiver through a feedback path;

a signal modulator for modulating the K signal streams, respectively; and

a stream processor for dividing respective K modulated signal streams into N substreams and multiplying the N substreams by the N transmission weights, respectively,

said receiver comprising:

a channel state estimating means for estimating a state of each communication channel from received signals received by the L antennas to output information of channel estimation, and including a channel information accumulation unit configured to accumulate the information of channel estimation as information of channel state for a predetermined interval;

a feedback signal generating means for generating feedback information according to the information of channel estimation;

a feedback-delay compensating means for processing the feedback information in order to compensate feedback-delay of the feedback path;

a received power estimation unit for estimating a condition of received power by using the information of channel estimation from the channel state estimating means, received signals received by L antennas and information of a known symbol;

a proper reception weight generating means for generating proper reception weights by using the condition of received power from the received power estimation unit, information of channel state from the channel information accumulation unit and the processed feedback information from the feedback-delay compensating means, wherein for the generation of the proper reception weights, the information of channel state from the channel information accumulation unit corresponds to a channel state estimated at a time when the transmission weights currently being used at the transmitter were calculated;

a reception weight multiplier for multiplying the received L substreams of respective K signal streams by the proper L reception weights, respectively;

a demodulator for composing the L weighted substreams to obtain respective composed K signal streams and demodulating the composed K signal streams, respectively; and

a signal combining unit corresponding to the signal dividing unit of the transmitter for combining the demodulated K signal streams from the demodulator to reproduce the original transmission signal.

Claim 2 (Currently Amended): A receiver having L (L is an integer equal to or greater than 2) antennas for an MIMO communication system comprising:

a channel state estimating means for estimating a state of each communication channel from received signals received by the L antennas to output information of channel estimation, and including a channel information accumulation unit configured to accumulate

the information of channel estimation as information of channel state for a predetermined interval;

a feedback signal generating means for generating feedback information according to the information of channel state;

a feedback-delay compensating means for processing the feedback information in order to compensate feedback-delay of a feedback path;

a received power estimation unit for estimating a condition of received power by using the information of channel estimation from the channel state estimating means, received signals received by L antennas and information of a known symbol;

a proper reception weight generating means for generating proper reception weights by using the condition of received power from the received power estimation unit, information of channel state from the channel information accumulation unit and processed feedback information from the feedback-delay compensating means, wherein for the generation of the proper reception weights, the information of channel state from the channel information accumulation unit corresponds to a channel state estimated at a time when the transmission weights currently being used at the transmitter were calculated;

a reception weight multiplier for multiplying the received L substreams of respective K signal streams (K is an integer equal to or less than smaller one of N or L) by the proper L reception weights, respectively;

a demodulator for composing the L weighted substreams to obtain respective composed K signal streams and demodulating the composed K signal streams, respectively; and

a signal combining unit for combining the demodulated K signal streams from the demodulator to reproduce an original transmission signal.

Claim 3 (Canceled).

Claim 4 (Previously Presented): A receiver according to claim 2,

wherein the channel state estimating means

outputs information of channel estimation;

the feedback signal generating means comprises:

a transmission weight generator for generating  $K \times N$  transmission weights based on the information of channel estimation from the channel state estimating means and sending the transmission weights as the feedback information to a transmitter through the feedback path;

the feedback-delay compensating means comprises:

a transmission weight accumulation unit for accumulating the transmission weights for a predetermined interval and outputting the accumulated transmission weights as the processed feedback information.

Claim 5 (Currently Amended): ~~A receiver according to claim 2,~~ A receiver having L  
(L is an integer equal to or greater than 2) antennas for an MIMO communication system  
comprising:

a channel state estimating means for estimating a state of each communication  
channel from received signals received by the L antennas to output information of channel  
state;

a feedback signal generating means for generating feedback information according to  
the information of channel state;

a feedback-delay compensating means for processing the feedback information in  
order to compensate feedback-delay of a feedback path;

a proper reception weight generating means for generating proper reception weights by using the information of channel state and processed feedback information from the feedback-delay compensating means;

a reception weight multiplier for multiplying the received L substreams of respective K signal streams (K is an integer equal to or less than smaller one of N or L) by the proper L reception weights, respectively;

a demodulator for composing the L weighted substreams to obtain respective composed K signal streams and demodulating the composed K signal streams, respectively;

a signal combining unit for combining the demodulated K signal streams from the demodulator to reproduce an original transmission signal; and

a received power estimation unit for estimating a condition of received power by using the information of channel estimation from the channel state estimating means, received signals received by L antennas and information of a known symbol,

wherein the channel state estimating means

outputs information of channel estimation

the feedback signal generating means comprises:

a transmission weight generator for generating  $K \times N$  transmission weights based on the information of channel estimation from the channel state estimating means and sending the transmission weights as the feedback information to a transmitter through the feedback path;

the feedback-delay compensating means comprises:

a transmission weight accumulation unit for accumulating the transmission weights for a predetermined interval and outputting the accumulated transmission weights as the processed feedback information; and

the proper reception weight generating means comprises:

a first reception weight generator for generating  $K \times L$  first reception weights by using the information of channel estimation from the channel state estimating means and processed feedback information from the transmission weight accumulation unit;

a second reception weight generator for generating  $K \times L$  second reception weights by using the information of channel state from the channel information accumulation unit and processed feedback information from the transmission weight accumulation unit;  
and

a weight selector for estimating a transmission quality according to the first reception weights, second reception weights, processed feedback information, information of channel state and the condition of received power from the received power estimation unit, and selecting the proper reception weights.

Claim 6 (Currently Amended): ~~A receiver according to claim 2,~~ A receiver having L  
(L is an integer equal to or greater than 2) antennas for an MIMO communication system  
comprising:

a channel state estimating means for estimating a state of each communication  
channel from received signals received by the L antennas to output information of channel  
state;

a feedback signal generating means for generating feedback information according to  
the information of channel state;

a feedback-delay compensating means for processing the feedback information in  
order to compensate feedback-delay of a feedback path;

a proper reception weight generating means for generating proper reception weights  
by using the information of channel state and processed feedback information from the  
feedback-delay compensating means;

a reception weight multiplier for multiplying the received L substreams of respective K signal streams (K is an integer equal to or less than smaller one of N or L) by the proper L reception weights, respectively;

a demodulator for composing the L weighted substreams to obtain respective composed K signal streams and demodulating the composed K signal streams, respectively;

a signal combining unit for combining the demodulated K signal streams from the demodulator to reproduce an original transmission signal; and

a received power estimation unit for estimating a condition of received power by using the information of channel estimation from the channel state estimating means, received signals received by L antennas and information of a known symbol,

wherein the channel state estimating means includes a channel information selector for selecting channel information to be used as the information of channel state for generating  $K \times L$  proper reception weights according to the information of channel estimation from the channel state estimating means, accumulated information of channel estimation in the channel information accumulation unit and condition of received power as well as given information of communication capacity, information of delay time of the communication channel and information of Doppler frequency;

the feedback signal generating means comprises:

a transmission weight generator for generating  $K \times N$  transmission weights based on the information of channel estimation from the channel state estimating means and sending the transmission weights as the feedback information to a transmitter through the feedback path;

the feedback-delay compensating means comprises:

a transmission weight accumulation unit for accumulating the transmission weights for a predetermined interval and outputting the accumulated transmission weights as the processed feedback information; and

the proper reception weight generating means comprises:

a reception weight generator for generating  $K \times L$  reception weights by using the selected channel information from the channel information selector and processed feedback information from the transmission weight accumulation unit.

Claim 7 (Previously Presented): A receiver according to claim 2,

wherein the channel state estimating means

outputs information of channel estimation and includes:

a channel information storage for storing past information of channel estimation which has been outputted from the channel state estimating means; and

a channel information adjusting unit for adjusting the information of channel estimation according to given information of time delay of the communication channel and the past information of channel estimation stored in the channel information storage and outputting adjusted information of channel estimation;

the feedback signal generating means comprises:

a transmission weight generator for generating  $K \times N$  transmission weights based on the adjusted information of channel estimation from the channel information adjusting unit and sending the transmission weights as the feedback information to a transmitter through the feedback path; and

the feedback-delay compensating means comprises:

a transmission weight accumulation unit for accumulating the transmission weights as the processed feedback information for a predetermined interval.



Claim 8 (Currently Amended): ~~A receiver according to claim 2,~~ A receiver having L  
(L is an integer equal to or greater than 2) antennas for an MIMO communication system  
comprising:

a channel state estimating means for estimating a state of each communication  
channel from received signals received by the L antennas to output information of channel  
state;

a feedback signal generating means for generating feedback information according to  
the information of channel state;

a feedback-delay compensating means for processing the feedback information in  
order to compensate feedback-delay of a feedback path;

a proper reception weight generating means for generating proper reception weights  
by using the information of channel state and processed feedback information from the  
feedback-delay compensating means;

a reception weight multiplier for multiplying the received L substreams of respective  
K signal streams (K is an integer equal to or less than smaller one of N or L) by the proper L  
reception weights, respectively;

a demodulator for composing the L weighted substreams to obtain respective  
composed K signal streams and demodulating the composed K signal streams, respectively;

a signal combining unit for combining the demodulated K signal streams from the  
demodulator to reproduce an original transmission signal; and

a received power estimation unit for estimating a condition of received power by  
using the information of channel estimation from the channel state estimating means,  
received signals received by L antennas and information of a known symbol,

wherein the channel state estimating means outputs information of channel estimation, and includes:

a channel information storage for storing past information of channel estimation which has been outputted from the channel state estimating means; and

a channel information adjusting unit for adjusting the information of channel estimation according to given information of time delay and the past information of channel estimation stored in the channel information storage and outputting adjusted information of channel estimation;

the feedback information generating means comprises:

a transmission weight generator for generating  $K \times N$  transmission weights based on the adjusted information of channel estimation from the channel information adjusting unit and sending the transmission weights as the feedback information to a transmitter through the feedback path;

the feedback-delay compensating means comprises:

a transmission weight accumulation unit for accumulating the transmission weights as the processed feedback information for a predetermined interval; and

the proper reception weight generating means comprises:

a first reception weight generator for generating  $K \times L$  first reception weights by using the adjusted information of channel estimation from the channel information adjusting unit and processed feedback information from the transmission weight accumulation unit;

a second reception weight generator for generating  $K \times L$  second reception weights by using the information of channel state from the channel information accumulation unit and processed feedback information from the transmission weight accumulation unit;  
and

a weight selector for estimating a transmission quality according to the first reception weights, second reception weights, processed feedback information, adjusted information of channel estimation and the condition of received power, and selecting reception weights to be used as the proper reception weights from the first or the second reception weights.

Claim 9 (Currently Amended): ~~A receiver according to claim 2;~~ A receiver having L  
(L is an integer equal to or greater than 2) antennas for an MIMO communication system  
comprising:

a channel state estimating means for estimating a state of each communication  
channel from received signals received by the L antennas to output information of channel  
state;

a feedback signal generating means for generating feedback information according to  
the information of channel state;

a feedback-delay compensating means for processing the feedback information in  
order to compensate feedback-delay of a feedback path;

a proper reception weight generating means for generating proper reception weights  
by using the information of channel state and processed feedback information from the  
feedback-delay compensating means;

a reception weight multiplier for multiplying the received L substreams of respective  
K signal streams (K is an integer equal to or less than smaller one of N or L) by the proper L  
reception weights, respectively;

a demodulator for composing the L weighted substreams to obtain respective  
composed K signal streams and demodulating the composed K signal streams, respectively;

a signal combining unit for combining the demodulated K signal streams from the demodulator to reproduce an original transmission signal; and

a received power estimation unit for estimating a condition of received power by using the information of channel estimation from the channel state estimating means, received signals received by L antennas and information of a known symbol,

wherein the channel state estimating means includes:

a channel information storage for storing past information of channel estimation which has been outputted from the channel state estimating means;

a channel information adjusting unit for adjusting the information of channel estimation according to given information of time delay and the past information of channel estimation stored in the channel information storage and outputting adjusted information of channel estimation; and

a channel information selector for selecting channel information as the information of channel state to be used for generation of the proper reception weights according to the adjusted information of channel estimation, adjusted and accumulated information of channel estimation in the channel information accumulation unit and the condition of received power as well as given information of communication capacity, information of delay time of the communication channel and information of Doppler frequency;

the feedback information generating means comprises:

a transmission weight generator for generating  $K \times N$  transmission weights based on the adjusted information of channel estimation from the channel information adjusting unit and sending the transmission weights as the feedback information to a transmitter through the feedback path;

the feedback-delay compensating means comprises:

a transmission weight accumulation unit for accumulating the transmission weights as the processed feedback information for a predetermined interval; and

the proper reception weight generating means comprises:

a reception weight generator for generating  $K \times L$  reception weights by using the information of channel state from the channel information selector and processed feedback information from the transmission weight accumulation unit.

Claims 10-11 (Canceled).

Claim 12 (Currently Amended): An MIMO communication system comprising:

a transmitter with  $N$  ( $N$  is an integer equal to or greater than 2) antennas; and a receiver with  $L$  ( $L$  is an integer equal to or greater than 2) antennas,

said transmitter comprising:

a transmission signal generator for generating a transmission signal;

a sender-side transmission weight generator for generating  $K \times N$  sender-side transmission weights based on feedback information from the receiver through a feedback path;

a signal dividing unit for dividing the transmission signal into  $K$  ( $K$  is an integer equal to or less than smaller one of  $N$  or  $L$ ) signal streams according to the sender-side transmission weights;

a signal modulator for modulating the  $K$  signal streams, respectively; and

a stream processor for dividing respective  $K$  modulated signal streams into  $N$  substreams and multiplying the  $N$  substreams by the sender-side  $N$  transmission weights, respectively; and

said receiver comprising:

a feedback information generating means for generating primitive feedback information from received L substreams received by the L antennas of the receiver, and including a channel state estimation unit for estimating a state of each communication channel from the received signals received by the L antennas to obtain information of channel estimation as the primitive feedback information;

a feedback-delay processing means for adjusting the primitive feedback information to obtain feedback information and sending the feedback information to the transmitter through the feedback path;

a feedback-delay compensating means for compensating a feedback-delay for the feedback information from the feedback-delay processing means, and including a channel information accumulation unit for accumulating the primitive feedback information from the channel state estimation unit;

a received power estimation unit for estimating a condition of received power by using the information of channel estimation from the channel state estimating means, received signals received by L antennas and information of a known symbol;

a proper reception weight generating means for generating  $K \times L$  proper reception weights by using the condition of received power from the received power estimation unit and the compensated feedback information from the feedback-delay compensating means, wherein for the generation of the proper reception weights, the compensated feedback information is based on the accumulated primitive feedback information from the channel information accumulation unit and corresponds to a channel state estimated at a time when the transmission weights currently being used at the transmitter were calculated;

a reception weight multiplier for multiplying the received L substreams of respective K signal streams by the proper L reception weights, respectively;

a demodulator for composing the L weighted substreams to obtain respective composed K signal streams and demodulating the composed K signal streams, respectively; and

a signal combining unit corresponding to the signal dividing unit of the transmitter for combining the demodulated K signal streams from the demodulator to reproduce the original transmission signal.

Claim 13 (Currently Amended): A receiver with L (L is an integer equal to or greater than 2) antennas in an MIMO communication system comprising:

a feedback information generating means for generating primitive feedback information from received L substreams received by the L antennas of the receiver, and including a channel state estimation unit for estimating a state of each communication channel from the received signals received by the L antennas to obtain information of channel estimation as the primitive feedback information;

a feedback-delay processing means for adjusting the primitive feedback information to obtain feedback information and sending the feedback information to a transmitter through a feedback path;

a feedback-delay compensating means for compensating a feedback-delay for the feedback information from the feedback-delay processing means, and including a channel information accumulation unit for accumulating the primitive feedback information from the channel state estimation unit;

a received power estimation unit for estimating a condition of received power by using the information of channel estimation from the channel state estimating means, received signals received by L antennas and information of a known symbol;

a proper reception weight generating means for generating  $K \times L$  proper reception weights by using the condition of received power from the received power estimation unit and the feedback-delay compensated feedback information from the feedback-delay compensating means, wherein for the generation of the proper reception weights, the compensated feedback information is based on the accumulated primitive feedback information from the channel information accumulation unit and corresponds to a channel state estimated at a time when the transmission weights currently being used at the transmitter were calculated;

a reception weight multiplier for multiplying the received  $L$  substreams of respective  $K$  signal streams by the proper  $L$  reception weights, respectively;

a demodulator for composing the  $L$  weighted substreams to obtain respective composed  $K$  signal streams and demodulating the composed  $K$  signal streams, respectively; and

a signal combining unit for combining the demodulated  $K$  signal streams from the demodulator to reproduce an original transmission signal.

Claim 14 (Previously Presented): A receiver according to claim 13,

wherein the channel state estimation unit also works as the feedback-delay processing means for sending the primitive feedback information as the feedback information to the transmitter through the feedback path and to the feedback-delay compensating means;

the feedback-delay compensating means comprises:

a receiver-side transmission weight generator for generating  $K \times N$  receiver-side transmission weights as the feedback-delay compensated feedback information based on the accumulated primitive feedback information from the channel information accumulation unit; and



the proper reception weight generating means comprises:

a reception weight generator for generating  $K \times L$  proper reception weights by using the accumulated primitive feedback information from the channel information accumulation unit and the feedback-delay compensated feedback information from the transmission weight generator.

Claim 15 (Currently Amended): ~~A receiver according to claim 13,~~ A receiver with L (L is an integer equal to or greater than 2) antennas in an MIMO communication system comprising:

a feedback information generating means for generating primitive feedback information from received L substreams received by the L antennas of the receiver, and including a channel state estimation unit for estimating a state of each communication channel from the received signals received by the L antennas to obtain information of channel estimation as the primitive feedback information;

a feedback-delay processing means for adjusting the primitive feedback information to obtain feedback information and sending the feedback information to a transmitter through a feedback path;

a feedback-delay compensating means for compensating a feedback-delay for the feedback information from the feedback-delay processing means, and including a channel information accumulation unit for accumulating the primitive feedback information from the channel state estimation unit;

a proper reception weight generating means for generating  $K \times L$  proper reception weights by using the feedback-delay compensated feedback information from the feedback-delay compensating means;

a reception weight multiplier for multiplying the received L substreams of respective K signal streams by the proper L reception weights, respectively;

a demodulator for composing the L weighted substreams to obtain respective composed K signal streams and demodulating the composed K signal streams, respectively;

a signal combining unit for combining the demodulated K signal streams from the demodulator to reproduce an original transmission signal; and

a received power estimation unit for estimating a condition of received power by using the information of channel estimation from the channel state estimating means, received signals received by L antennas and information of a known symbol,

wherein the channel state estimating unit also works as the feedback-delay processing means for sending the primitive feedback information as the feedback information to the transmitter through the feedback path and to the feedback-delay compensating means;

the feedback-delay compensating means comprises:

a receiver-side transmission weight generator for generating  $K \times N$  receiver-side transmission weights as the feedback-delay compensated feedback information based on the accumulated primitive feedback information from the channel information accumulation unit; and

the proper reception weight generating means comprises:

a first reception weight generator for generating  $K \times L$  first reception weights by using the information of channel estimation from the channel state estimation unit and the feedback-delay compensated feedback information from the transmission weight generator;

a second reception weight generator for generating  $K \times L$  second reception weights by using the accumulated primitive feedback information from the channel information accumulation unit and the receiver-side transmission weights from the transmission weight generator; and

a weight selector for estimating a transmission quality according to the first reception weights, second reception weights, receiver-side transmission weights, information of channel estimation and the condition of received power, and selecting the proper reception weights from the first or second reception weights.

Claim 16 (Currently Amended): ~~A receiver according to claim 13,~~ A receiver with L (L is an integer equal to or greater than 2) antennas in an MIMO communication system comprising:

a feedback information generating means for generating primitive feedback information from received L substreams received by the L antennas of the receiver, and including a channel state estimation unit for estimating a state of each communication channel from the received signals received by the L antennas to obtain information of channel estimation as the primitive feedback information;

a feedback-delay processing means for adjusting the primitive feedback information to obtain feedback information and sending the feedback information to a transmitter through a feedback path;

a feedback-delay compensating means for compensating a feedback-delay for the feedback information from the feedback-delay processing means, and including a channel information accumulation unit for accumulating the primitive feedback information from the channel state estimation unit;

a proper reception weight generating means for generating  $K \cdot L$  proper reception weights by using the feedback-delay compensated feedback information from the feedback-delay compensating means;

a reception weight multiplier for multiplying the received L substreams of respective K signal streams by the proper L reception weights, respectively;

a demodulator for composing the L weighted substreams to obtain respective composed K signal streams and demodulating the composed K signal streams, respectively;

a signal combining unit for combining the demodulated K signal streams from the demodulator to reproduce an original transmission signal; and

a received power estimation unit for estimating a condition of received power by using the information of channel estimation from the channel state estimating means, received signals received by L antennas and information of a known symbol,

wherein the channel state estimating means also works as the feedback-delay processing means for sending the primitive feedback information as the feedback information to the transmitter through the feedback path and to the feedback-delay compensating means;

the feedback-delay compensating means comprises:

a receiver-side transmission weight generator for generating  $K \times N$  receiver-side transmission weights as the feedback-delay compensated feedback information based on the accumulated primitive feedback information from the channel information accumulation unit; and

the proper reception weight generating means comprises:

a channel information selector for selecting channel information to be used for generation of  $K \times L$  proper reception weights according to the information of channel estimation, accumulated information of channel estimation in the channel information accumulation unit and the condition of received power as well as given information of communication capacity, information of delay time and information of Doppler frequency; and

a reception weight generator for generating  $K \times L$  proper reception weights by using the selected channel information from the channel information selector and the

feedback-delay compensated feedback information from the receiver-side transmission weight accumulation unit.

Claim 17 (Previously Presented): A receiver according to claim 13,  
wherein the feedback information processing means comprises:

a channel information storage for storing past information of channel estimation which has been outputted from the channel state estimation unit;

a channel information adjusting unit for adjusting the information of channel estimation according to given information of time delay and the past information of channel estimation stored in the channel information storage and sending the adjusted information of channel estimation as the feedback information to a transmitter through a feedback path

wherein the channel information accumulation unit accumulates the adjusted information of channel estimation from the channel information adjusting unit for a predetermined interval;

the feedback-delay compensating means comprises:

a receiver-side transmission weight generator for generating  $K \times N$  receiver-side transmission weights based on the adjusted and accumulated information of channel estimation in the channel information accumulation unit;

a transmission weight accumulation unit for accumulating the receiver-side transmission weights from the receiver-side transmission weight generator for a predetermined interval and outputting the receiver-side transmission weights as the feedback-delay compensated feedback information to the proper reception weight generating means;  
and

the proper reception weight generating means comprises:

a reception weight generator for generating the proper L reception weights by using the adjusted and accumulated information of channel estimation from the channel information accumulation unit and the feedback-delay compensated feedback information from the transmission weight generator.

Claim 18 (Currently Amended): ~~A receiver according to claim 13,~~ A receiver with L (L is an integer equal to or greater than 2) antennas in an MIMO communication system comprising:

a feedback information generating means for generating primitive feedback information from received L substreams received by the L antennas of the receiver, and including a channel state estimation unit for estimating a state of each communication channel from the received signals received by the L antennas to obtain information of channel estimation as the primitive feedback information;

a feedback-delay processing means for adjusting the primitive feedback information to obtain feedback information and sending the feedback information to a transmitter through a feedback path;

a feedback-delay compensating means for compensating a feedback-delay for the feedback information from the feedback-delay processing means, and including a channel information accumulation unit for accumulating the primitive feedback information from the channel state estimation unit;

a proper reception weight generating means for generating  $K \times L$  proper reception weights by using the feedback-delay compensated feedback information from the feedback-delay compensating means;

a reception weight multiplier for multiplying the received L substreams of respective K signal streams by the proper L reception weights, respectively;

a demodulator for composing the L weighted substreams to obtain respective composed K signal streams and demodulating the composed K signal streams, respectively;

a signal combining unit for combining the demodulated K signal streams from the demodulator to reproduce an original transmission signal; and

a received power estimation unit for estimating a condition of received power by using the information of channel estimation from the channel state estimating means, received signals received by L antennas and information of a known symbol,

wherein the feedback information processing means comprises:

a channel information storage for storing past information of channel estimation which has been outputted from the channel state estimation unit; and

a channel information adjusting unit for adjusting the information of channel estimation according to given information of time delay and the past information of channel estimation stored in the channel information storage and sending the adjusted information of channel estimation as the feedback information to the transmitter through the feedback path;

wherein the channel information accumulation unit accumulates the adjusted information of channel estimation from the channel information adjusting unit for a predetermined interval;

the feedback-delay compensating means comprises:

a receiver-side transmission weight generator for generating  $K \times N$  receiver-side transmission weights based on the adjusted and accumulated information of channel estimation in the channel information accumulation unit; and

a transmission weight accumulation unit for accumulating the receiver-side transmission weights from the receiver-side transmission weight generator for a predetermined interval as the feedback-delay compensated feedback information; and

the proper reception weight generating means comprises:

a first reception weight generator for generating  $K \times L$  first reception weights by using the adjusted information of channel estimation from the channel state estimation unit and the feedback-delay compensated feedback information from the transmission weight accumulation unit;

a second reception weight generator for generating  $K \times L$  second reception weights by using the adjusted and accumulated information of channel estimation in the channel information accumulation unit and the feedback-delay compensated feedback information from the transmission weight accumulation unit; and

a weight selector for estimating a transmission quality according to the first reception weights, second reception weights, feedback-delay compensated feedback information, adjusted information of channel estimation from the channel information adjusting unit and the condition of received power, and selecting the proper reception weights from the first or the second reception weights.

Claim 19 (Currently Amended): ~~A receiver according to claim 13,~~ A receiver with L (L is an integer equal to or greater than 2) antennas in an MIMO communication system comprising:

a feedback information generating means for generating primitive feedback information from received L substreams received by the L antennas of the receiver, and including a channel state estimation unit for estimating a state of each communication channel from the received signals received by the L antennas to obtain information of channel estimation as the primitive feedback information;

a feedback-delay processing means for adjusting the primitive feedback information to obtain feedback information and sending the feedback information to a transmitter through a feedback path;



a feedback-delay compensating means for compensating a feedback-delay for the feedback information from the feedback-delay processing means, and including a channel information accumulation unit for accumulating the primitive feedback information from the channel state estimation unit;

a proper reception weight generating means for generating  $K \times L$  proper reception weights by using the feedback-delay compensated feedback information from the feedback-delay compensating means;

a reception weight multiplier for multiplying the received  $L$  substreams of respective  $K$  signal streams by the proper  $L$  reception weights, respectively;

a demodulator for composing the  $L$  weighted substreams to obtain respective composed  $K$  signal streams and demodulating the composed  $K$  signal streams, respectively;

a signal combining unit for combining the demodulated  $K$  signal streams from the demodulator to reproduce an original transmission signal; and

a received power estimation unit for estimating a condition of received power by using the information of channel estimation from the channel state estimating means, received signals received by  $L$  antennas and information of a known symbol,

wherein the feedback information processing means comprises:

a channel information storage for storing past information of channel estimation which has been outputted from the channel state estimation unit;

a channel information adjusting unit for adjusting the information of channel estimation according to given information of time delay of the communication channel and the past information of channel estimation stored in the channel information storage and sending the adjusted information of channel estimation as the feedback information to the transmitter through the feedback path;

wherein the channel information accumulation unit accumulates the adjusted information of channel estimation from the channel information adjusting unit for a predetermined interval;

the feedback-delay compensating means comprises:

a receiver-side transmission weight generator for generating  $K \times N$  receiver-side transmission weights based on the adjusted and accumulated information of channel estimation in the channel information accumulation unit; and

a transmission weight accumulation unit for accumulating the receiver-side transmission weights from the receiver-side transmission weight generator for a predetermined interval as the feedback-delay compensated feedback information; and

the proper reception weight generating means comprises:

a channel information selector for selecting channel information to be used for generation of  $K \times L$  proper reception weights according to the adjusted information of channel estimation, adjusted and accumulated information of channel estimation in the channel information accumulation unit and the condition of received power as well as given information of communication capacity, information of delay time of the communication channel and information of Doppler frequency; and

a reception weight generator for generating  $K \times L$  proper reception weights by using the selected channel information from the channel information selector and the feedback-delay compensated feedback information from the receiver-side transmission weight accumulation unit.

Claim 20 (Previously Presented): A receiver according to claim 13,  
wherein the feedback information processing means comprises:

a channel information storage for storing past information of channel estimation which has been generated by the channel state estimation unit; and

a channel information adjusting unit for adjusting the information of channel estimation according to the past information of channel estimation stored in the channel information storage and given information of time delay and sending the adjusted channel information as the feedback information to the transmitter through the feedback path;

wherein the channel information accumulation unit accumulates the adjusted channel information from the channel information adjusting unit for a predetermined interval;

the feedback-delay compensating means comprises:

a receiver-side transmission weight generator for generating  $K \times N$  receiver-side transmission weights as the feedback-delay compensated feedback information by using the adjusted and accumulated channel information in the channel information accumulation unit; and

the proper reception weight generating means comprises:

a reception weight generator for generating  $K \times L$  proper reception weights by using the information of channel estimation from the channel state estimation unit and the feedback-delay compensated feedback information.

Claims 21-22 (Canceled).

Claim 23 (Currently Amended): A method of receiving and reproducing MIMO transmission signal comprising:

estimating a state of each communication channel from received signals received by  $L$  antennas of an MIMO receiver to obtain and output information of channel estimation as information of channel state;

accumulating the information of channel estimation as the information of channel state for a predetermined interval;

generating feedback information according to the information of channel state;

sending the feedback information to a transmitter through a feedback path;

processing the feedback information in order to compensate feedback-delay of a feedback path;

estimating a condition of received power by using information of channel estimation, received signals received by L antennas and information of a known symbol;

generating  $K \times L$  proper reception weights by using the estimated condition of received power and the accumulated information of channel state and processed feedback information, wherein for the generation of the proper reception weights, the accumulated information of channel state corresponds to a channel state estimated at a time when the transmission weights currently being used at the transmitter were calculated;

multiplying the received L substreams of respective K signal streams by the proper L reception weights, respectively;

composing the L weighted substreams to obtain respective composed K signal streams;

demodulating the composed K signal streams, respectively; and

combining the demodulated K signal streams to reproduce an original transmission signal.

Claim 24 (Previously Presented): A method of receiving and reproducing MIMO transmission signal according to claim 23,

wherein the generating the feedback information includes generating  $K \times N$  transmission weights based on the information of channel estimation;

the sending the feedback information includes sending the transmission weights as the feedback information to the transmitter through the feedback path;

the processing the feedback information includes accumulating the transmission weights as the processed feedback information for a predetermined interval

Claim 25 (Previously Presented): A method of receiving and reproducing MIMO transmission signal according to claim 23,

wherein the generating the feedback information includes generating  $K \times N$  transmission weights based on the information of channel estimation;

the sending the feedback information includes sending the transmission weights as the feedback information to the transmitter through the feedback path; and

the processing the feedback information includes accumulating the transmission weights as the processed feedback information for a predetermined interval.

Claim 26 (Currently Amended): ~~A method of receiving and reproducing MIMO transmission signal according to claim 23,~~ A method of receiving and reproducing MIMO transmission signal comprising:

estimating a state of each communication channel from received signals received by L antennas of an MIMO receiver to obtain and output information of channel state;

generating feedback information according to the information of channel state;

sending the feedback information to a transmitter through a feedback path;

processing the feedback information in order to compensate feedback-delay of a feedback path;

generating  $K \times L$  proper reception weights by using the information of channel state and processed feedback information;

multiplying the received L substreams of respective K signal streams by the proper L reception weights, respectively;

composing the L weighted substreams to obtain respective composed K signal streams;

demodulating the composed K signal streams, respectively;

combining the demodulated K signal streams to reproduce an original transmission signal;

estimating a condition of received power by using information of channel estimation, received signals received by L antennas and information of a known symbol,

wherein the generating the feedback information includes generating  $K \times N$  transmission weights as the feedback information based on the information of channel estimation;

the processing the feedback information includes accumulating the transmission weights as the processed feedback information for a predetermined interval; and

the generating  $K \times L$  proper reception weights includes:

generating  $K \times L$  first reception weights by using the information of channel estimation and processed feedback information;

generating  $K \times L$  second reception weights by using the information of channel state and processed feedback information;

estimating a transmission quality according to the first reception weights, second reception weights, processed feedback information, information of channel state and the condition of received power; and

selecting the proper reception weights from the first or the second reception weights.

Claim 27 (Currently Amended): ~~A method of receiving and reproducing an MIMO transmission signal according to claim 23,~~ A method of receiving and reproducing MIMO transmission signal comprising:

estimating a state of each communication channel from received signals received by L antennas of an MIMO receiver to obtain and output information of channel state;

generating feedback information according to the information of channel state;

sending the feedback information to a transmitter through a feedback path;

processing the feedback information in order to compensate feedback-delay of a feedback path;

generating  $K \times L$  proper reception weights by using the information of channel state and processed feedback information;

multiplying the received L substreams of respective K signal streams by the proper L reception weights, respectively;

composing the L weighted substreams to obtain respective composed K signal streams;

demodulating the composed K signal streams, respectively;

combining the demodulated K signal streams to reproduce an original transmission signal;

estimating a condition of received power by using information of channel estimation, received signals received by L antennas and information of a known symbol,

wherein the estimating a state of each communication channel includes selecting channel information to be used as the information of channel state for generation of the proper L reception weights according to the information of channel estimation, accumulated information of channel estimation and the condition of received power as well as given

information of communication capacity, information of delay time of the communication channel and information of Doppler frequency;

the generating the feedback information includes generating  $K*N$  transmission weights based on the information of channel estimation;

the sending the feedback information includes sending the transmission weights as the feedback information to the transmitter through the feedback path; and

the processing the feedback information includes accumulating the transmission weights for a predetermined interval to obtain accumulated transmission weights as the processed feedback information.

Claim 28 (Previously Presented): A method of receiving and reproducing MIMO transmission signal according to claim 23,

wherein the estimating a state of each communication channel includes:

storing past information of channel estimation;

adjusting the information of channel estimation according to given information of time delay and the past information of channel estimation to obtain adjusted information of channel estimation; and

accumulating the adjusted information of channel estimation as the information of channel state for a predetermined interval;

the generating the feedback information includes generating  $K*N$  transmission weights based on the adjusted information of channel estimation;

the sending the feedback information includes sending the transmission weights as the feedback information to the transmitter through the feedback path; and

the processing the feedback information includes accumulating the transmission weights as the processed feedback information for a predetermined interval.



Claim 29 (Currently Amended): ~~A method of receiving and reproducing MIMO transmission signal according to claim 23;~~ A method of receiving and reproducing MIMO transmission signal comprising:

estimating a state of each communication channel from received signals received by L antennas of an MIMO receiver to obtain and output information of channel state;

generating feedback information according to the information of channel state;

sending the feedback information to a transmitter through a feedback path;

processing the feedback information in order to compensate feedback-delay of a feedback path;

generating  $K \times L$  proper reception weights by using the information of channel state and processed feedback information;

multiplying the received L substreams of respective K signal streams by the proper L reception weights, respectively;

composing the L weighted substreams to obtain respective composed K signal streams;

demodulating the composed K signal streams, respectively;

combining the demodulated K signal streams to reproduce an original transmission signal;

estimating a condition of received power by using information of channel estimation, received signals received by L antennas and information of a known symbol,

wherein the estimating a state of each communication channel includes:

storing past information of channel estimation which has been obtained;

adjusting the information of channel estimation according to given information of time delay and the stored past information of channel estimation; and

accumulating the adjusted information of channel estimation as the information of channel state for a predetermined interval;

the generating the feedback information includes generating  $K \times N$  transmission weights based on the adjusted information of channel estimation;

the sending the feedback information includes sending the transmission weights as the feedback information to the transmitter through the feedback path;

the processing the feedback information includes accumulating the transmission weights as the processed feedback information for a predetermined interval; and

the generating  $K \times L$  proper reception weights includes:

generating  $K \times L$  first reception weights by using the adjusted information of channel estimation and processed feedback information;

generating  $K \times L$  second reception weights by using the information of channel state and processed feedback information;

estimating a transmission quality according to the first reception weights, second reception weights, processed feedback information, adjusted information of channel estimation and the condition of received power; and

selecting reception weights to be used as the proper reception weights from the first or the second reception weights.

Claim 30 (Currently Amended): ~~A method of receiving and reproducing MIMO transmission signal according to claim 23, further comprising:~~ A method of receiving and reproducing MIMO transmission signal comprising:

estimating a state of each communication channel from received signals received by L antennas of an MIMO receiver to obtain and output information of channel state;

generating feedback information according to the information of channel state;

sending the feedback information to a transmitter through a feedback path;

processing the feedback information in order to compensate feedback-delay of a feedback path;

generating  $K \times L$  proper reception weights by using the information of channel state and processed feedback information;

multiplying the received  $L$  substreams of respective  $K$  signal streams by the proper  $L$  reception weights, respectively;

composing the  $L$  weighted substreams to obtain respective composed  $K$  signal streams;

demodulating the composed  $K$  signal streams, respectively;

combining the demodulated  $K$  signal streams to reproduce an original transmission signal;

estimating a condition of received power by using information of channel estimation, received signals received by  $L$  antennas and information of a known symbol,

wherein the estimating a state of each communication channel includes:

storing past information of channel estimation which has been obtained;

adjusting the information of channel estimation according to given information of time delay and the stored past information of channel estimation to obtain adjusted information of channel estimation;

accumulating the adjusted information of channel estimation for a predetermined interval; and

selecting channel information as the information of channel state to be used for generation of the proper  $L$  reception weights according to the adjusted information of channel estimation, adjusted and accumulated information of channel estimation and the condition of received power as well as given information of communication capacity,

information of delay time of the communication channel and information of Doppler frequency;

the generating the feedback information includes generating  $K*N$  transmission weights based on the adjusted information of channel estimation;

the sending the feedback information includes sending the transmission weights as the feedback information to the transmitter through the feedback path; and

the processing the feedback information includes accumulating the transmission weights as the processed feedback information for a predetermined interval.

Claims 31-32 (Canceled).

Claim 33 (Currently Amended): A method of receiving and reproducing MIMO transmission signal comprising:

generating primitive feedback information from received  $L$  substreams received by  $L$  antennas of a receiver;

adjusting the primitive feedback information to obtain feedback information;

sending the feedback information to a transmitter through a feedback path;

compensating feedback-delay for the feedback information;

accumulating the feedback information for a predetermined interval;

estimating a condition of received power by using the information of channel estimation, received signals received by  $L$  antennas and information of a known symbol;

generating  $K*L$  proper reception weights by using the estimated condition of received power and the feedback-delay compensated feedback information, wherein for the generation of the proper reception weights, the feedback-delay compensated feedback information is based on the accumulated feedback information and corresponds to a channel state estimated

at a time when the transmission weights currently being used at the transmitter were calculated;

    multiplying the received L substreams of respective K signal streams by the proper L reception weights, respectively;

    composing the L weighted substreams to obtain respective composed K signal streams;

    demodulating the composed K signal streams, respectively; and

    combining the demodulated K signal streams to reproduce an original transmission signal.

Claim 34 (Previously Presented): A method of receiving and reproducing MIMO transmission signal according to claim 33,

    the generating primitive feedback information includes estimating a state of each communication channel from the received signals received by the L antennas to obtain information of channel estimation as the primitive feedback information;

    the adjusting the primitive feedback information includes making the primitive feedback information itself as the feedback information;

    the compensating feedback-delay includes:

        accumulating the feedback information for a predetermined interval; and

        generating  $K*N$  receiver-side transmission weights as the feedback-delay compensated feedback information based on the accumulated feedback information; and

    the generating  $K*L$  proper reception weights is performed by using the accumulated feedback information and feedback-delay compensated feedback information.

Claim 35 (Currently Amended): ~~A method of receiving and reproducing MIMO transmission signal according to claim 33;~~

A method of receiving and reproducing MIMO transmission signal comprising:  
generating primitive feedback information from received L substreams received by L  
antennas of a receiver;

adjusting the primitive feedback information to obtain feedback information;  
sending the feedback information to a transmitter through a feedback path;  
compensating feedback-delay for the feedback information;  
generating  $K \times L$  proper reception weights by using the feedback-delay compensated  
feedback information;

multiplying the received L substreams of respective K signal streams by the proper L  
reception weights, respectively;

composing the L weighted substreams to obtain respective composed K signal  
streams;

demodulating the composed # K signal streams, respectively;  
combining the demodulated K signal streams to reproduce an original transmission  
signal; and

estimating a condition of received power by using information of channel estimation,  
received signals received by L antennas and information of a known symbol,

wherein the generating primitive feedback information includes estimating a state of each communication channel from the received signals received by the L antennas to obtain the information of channel estimation as the primitive feedback information;

the adjusting the primitive feedback information includes making the primitive feedback information itself as the feedback information;

the compensating feedback-delay includes generating  $K*N$  receiver-side transmission weights as the feedback-delay compensated feedback information based on the accumulated feedback information; and

the generating  $K*L$  proper reception weights includes:

generating  $K*L$  first reception weights by using the information of channel estimation and feedback-delay compensated feedback information;

generating  $K*L$  second reception weights by using the accumulated feedback information and receiver-side transmission weights;

estimating a transmission quality according to the first reception weights, second reception weights, receiver-side transmission weights, information of channel estimation and the condition of received power; and

selecting the proper reception weights from the first or second reception weights according to the transmission quality.

Claim 36 (Previously Presented): A method of receiving and reproducing MIMO transmission signal according to claim 33,

wherein the generating the primitive feedback information includes estimating a state of each communication channel from the received signals received by the  $L$  antennas to obtain the information of channel estimation as the primitive feedback information;

wherein the adjusting the primitive feedback information includes making the primitive feedback information itself as the feedback information;

the compensating feedback-delay includes:

accumulating the feedback information for a predetermined interval; and

generating  $K*N$  receiver-side transmission weights as the feedback-delay compensated feedback information based on the accumulated feedback information; and

the generating  $K \times L$  proper reception weights includes:

selecting channel information to be used for generation of  $K \times L$  proper reception weights according to the primitive feedback information, accumulated feedback information and the condition of received power as well as given information of communication capacity, information of delay time and information of Doppler frequency;  
and

generating  $K \times L$  proper reception weights by using the selected channel information and the feedback-delay compensated feedback information.

Claim 37 (Previously Presented): A method of receiving and reproducing MIMO transmission signal according to claim 33,

wherein the generating primitive feedback information includes estimating a state of each communication channel from the received signals received by the  $L$  antennas and outputting information of channel estimation as the primitive feedback information;

the adjusting the primitive feedback information includes:

storing past information of channel estimation which has been outputted;

adjusting the information of channel estimation according to given information of time delay and the stored past information of channel estimation;

the sending the feedback information includes sending the adjusted information of channel estimation as the feedback information to the transmitter through the feedback path;  
and

the compensating feedback-delay includes:

accumulating the adjusted information of channel estimation for a predetermined interval as accumulated feedback information;



generating  $K*N$  receiver-side transmission weights based on the accumulated feedback information; and

accumulating the receiver-side transmission weights for a predetermined interval as the feedback-delay compensated feedback information; and

the generating  $K*L$  proper reception weights is performed by using the accumulated feedback information and the feedback-delay compensated feedback information.

Claim 38 (Currently Amended): ~~A method of receiving and reproducing MIMO transmission signal according to claim 33,~~ A method of receiving and reproducing MIMO transmission signal comprising:

generating primitive feedback information from received  $L$  substreams received by  $L$  antennas of a receiver;

adjusting the primitive feedback information to obtain feedback information;

sending the feedback information to a transmitter through a feedback path;

compensating feedback-delay for the feedback information;

generating  $K*L$  proper reception weights by using the feedback-delay compensated feedback information;

multiplying the received  $L$  substreams of respective  $K$  signal streams by the proper  $L$  reception weights, respectively;

composing the  $L$  weighted substreams to obtain respective composed  $K$  signal streams;

demodulating the composed  $K$  signal streams, respectively;

combining the demodulated  $K$  signal streams to reproduce an original transmission signal; and

estimating a condition of received power by using information of channel estimation,  
received signals received by L antennas and information of a known symbol,

wherein the generating primitive feedback information includes estimating a state of each communication channel from the received signals received by the L antennas to obtain the information of channel estimation as the primitive feedback information;

the adjusting the primitive feedback information includes:

storing past information of channel estimation which has been obtained by; and

adjusting the information of channel estimation according to given information of time delay and the past information of channel estimation;

the sending the feedback information includes sending the adjusted information of channel estimation as the feedback information to the transmitter through the feedback path;

the compensating feedback-delay includes:

accumulating the feedback information for a predetermined interval;

generating  $K*N$  receiver-side transmission weights based on the accumulated feedback information; and

accumulating the receiver-side transmission weights for a predetermined interval as the feedback-delay compensated feedback information; and

the generating  $K*L$  proper reception weights includes:

generating  $K*L$  first reception weights by using the feedback information and feedback-delay compensated feedback information;

generating  $K*L$  second reception weights by using the accumulated feedback information and the feedback-delay compensated feedback information; and

estimating a transmission quality according to the first reception weights, second reception weights, feedback-delay compensated feedback information, feedback information and the condition of received power; and

selecting the proper reception weights from the first or second reception weights according to the transmission quality.

Claim 39 (Currently Amended): ~~A method of receiving and reproducing MIMO transmission signal according to claim 33;~~ A method of receiving and reproducing MIMO transmission signal comprising:

generating primitive feedback information from received L substreams received by L antennas of a receiver;

adjusting the primitive feedback information to obtain feedback information;

sending the feedback information to a transmitter through a feedback path;

compensating feedback-delay for the feedback information;

generating  $K \times L$  proper reception weights by using the feedback-delay compensated feedback information;

multiplying the received L substreams of respective K signal streams by the proper L reception weights, respectively;

composing the L weighted substreams to obtain respective composed K signal streams;

demodulating the composed # K signal streams, respectively;

combining the demodulated K signal streams to reproduce an original transmission signal; and

estimating a condition of received power by using information of channel estimation, received signals received by L antennas and information of a known symbol,

wherein the generating primitive feedback information includes estimating a state of each communication channel from the received signals received by the L antennas to obtain information of channel estimation as the primitive feedback information;

the adjusting the primitive feedback information includes:

storing past information of channel estimation which has been outputted;

adjusting the information of channel estimation according to given information of time delay and the stored past information of channel estimation;

the sending the feedback information includes sending the adjusted information of channel estimation as the feedback information to the transmitter through the feedback path;

the compensating feedback-delay includes:

accumulating the feedback information for a predetermined interval;

generating  $K*N$  receiver-side transmission weights based on the accumulated feedback information; and

accumulating the receiver-side transmission weights for a predetermined interval as the feedback-delay compensated feedback information; and

the generating  $K*L$  proper reception weights includes:

selecting channel information to be used for generation of  $K*L$  proper reception weights according to the feedback information, accumulated feedback information and the condition of received power as well as given information of communication capacity, information of delay time and information of Doppler frequency; and

generating  $K*L$  proper reception weights by using the selected channel information and the feedback-delay compensated feedback information.

Claim 40 (Previously Presented): A method of receiving and reproducing MIMO transmission signal according to claim 33,

wherein the generating primitive feedback information includes estimating a state of each communication channel from the received signals received by the  $L$  antennas to obtain information of channel estimation as the primitive feedback information;

the adjusting the primitive feedback information includes:

- storing past information of channel estimation; and
- adjusting the information of channel estimation according to the stored past information of channel estimation and given information of time delay;

the sending the feedback information includes sending the adjusted channel information as the feedback information to the transmitter through the feedback path;

the compensating feedback-delay includes:

- accumulating the feedback information for a predetermined interval; and
- generating  $K \times N$  receiver-side transmission weights as the feedback-delay compensated feedback information by using the accumulated feedback information; and

the generating  $K \times L$  proper reception weights is performed by using the primitive feedback information and the feedback-delay compensated feedback information.

Claims 41-42 (Canceled).